Subcommittee on Environment and Hazardous Materials
Wednesday, November 16, 2005, at 2:00 p.m. in 2322 Rayburn House Office Building
"Superfund Laws and Animal Agriculture."

Testimony of Robert S. Lawrence, MD

Preface – statement: The post World War II industrialization of agriculture has had a profound impact on animal husbandry in the United States. As family farm production of food animals was replaced by Concentrated Animal Feeding Operations or CAFOs, neighboring residents and communities where CAFOs have been built have experienced a number of profound changes in the quality of the environment, threats to public health, and significant stress to the fabric of rural communities. All of these important issues deserve full and serious consideration. My testimony, however, will not attempt to comment on all of the issues. Instead, I am here to share what is known about how CAFOs harm the environment and threaten the health of the public.

The key messages for policy makers in applying Superfund Laws to Animal Agriculture are:

1. ***Current methods of industrial animal production (IAP) and CAFOs harm the environment and threaten the public's health.***

2. ***Industrial animal production (IAP) results in the release of high levels of gases, odors, nutrients, pathogens and antibiotic resistant bacteria into the air, water, and soil.***

3. ***Current waste management practices in industrial animal production threaten the environment and public health.***

4. ***Feed ingredients used in industrial animal production are undermining the effectiveness of antibiotics in medical care.***

Introduction

Over the past 50 years, food animal production in the US has undergone a transformation. First developed in the poultry industry during the 1930s and 1940s, the industrial procedures of growing and processing large numbers of animals in heavy concentration has been adopted by the beef cattle, hog, dairy and some other industries. In today's industrial animal production (IAP) system, most animals grow to market weight in facilities know as concentrated animal feeding operations (CAFOs). The US EPA criteria for CAFO designation are species-specific and indicate the minimum numbers of animals per operation. CAFOs now dominate US livestock and poultry production. To illustrate this trend toward greater concentration of production, consider that in 1966, 57 million hogs were raised on one million US farms. In 2001 approximately the same number of hogs was raised on 80,000 farms (more than half were raised in just 5,000 facilities). The total production of hogs is now about 100 million per year. (USDA National Agriculture Statistics Service and US Census of Agriculture)

Today, animal production in the US is dominated by vertically integrated industries managing production from genetics of the breeding stock to finished products ready to be cooked for the table. High throughput is achieved through intensive operations under confined conditions that harm the environment and threaten public health in many ways. These factors led the American Public Health Association in 2003 to adopt a resolution calling for a moratorium on the building of new CAFOs until additional data can be gathered and policies implemented to protect public health. (APHA, 2004)

1. Current methods of industrial animal production (IAP) and CAFOs harm the environment and threaten the public's health.

Harm to the Environment

CAFOs generate and introduce huge amounts of waste to the environment. As of 1997, animal production in the US created approximately 1.4 billion tons of waste. This amount is the equivalent to about 5 tons of animal waste for each person in the country (Horrigan, 2002). Another way to look at this problem is to consider that since a hog produces about four times as much solid waste as an average person, a typical CAFO raising 10,000 hogs is equivalent to a small city of 40,000 people with no sewage treatment or modern sanitation facilities.

CAFOs generally produce more waste than can be utilized as fertilizer on nearby fields, and transportation costs prohibit shipping the waste to more distant croplands. These wastes are difficult to store because of the sheer volume produced and the expense associated with transporting. Storage cesspits for hog waste or poultry waste piles leak and pollute groundwater and streams. Waste from storage pits that is land applied can pollute the air, surface water, and shallow aquifers (Wing, 2002). The amount of phosphorus and nitrogen in the waste usually exceeds what crops can utilize or the soil can retain. Surface water can become contaminated and lead to algal blooms, eutrophication (Osterberg, 2004, APHA, 2004) and serious public health risks of pathogenic micro-organisms (Wing, 2000, Hamscher, 2003).

The experiences of large swine-producing states, such as North Carolina and Iowa, have shown that deep CAFO cesspits can leak and overflow into ground waters and nearby surface waters. A report produced by the Iowa State University Extension, in collaboration with the Iowa Department of Natural Resources, noted that from 1992-1998, 86 uncontrolled discharges into surface waters were reported, with 20 discharges associated with formed cesspits (Lorimor, 1999). These discharges, along with runoff from areas where manure is land applied, can contaminate both ground waters and surface waters with pathogenic microbes and nutrients that can cause human illnesses.

Threats to the Public's Health

In addition to the environmental impacts mentioned above, CAFO-generated wastes create many public health risks. (Wing, 2000, APHA 2004) A key issue is that animal feeds used in CAFOs may also include animal wastes, animal tissues and animal by-products, and other additives that can contaminate human food or the environment. Many feed ingredients used in CAFOs pass through the animal directly into manure, including heavy metals such as arsenic, antibiotics, nitrogen and phosphorus (Arai, 2003; Lasky, 2004; Silbergeld, 2004).

CAFO-generated wastes also contain pathogens that can cause disease in humans, including *Salmonella*, *Campylobacter*, and *Cryptosporidium*, and can pollute drinking water with nitrates in concentrations potentially fatal to infants. The presence of excessive nitrates in drinking water has been associated with blue-baby syndrome or methemoglobinemia, a cause of both illness and death in infants (Fan, 1996; Johnson, 1990). Some studies also suggest that the development of blue-baby syndrome is more likely when the nitrate-containing water supply is also contaminated with bacteria—a situation that may be expected when groundwater is contaminated with animal feces (Cole, 2000; Fan, 1996). In addition, animal studies and some human studies suggest that developmental defects in the central nervous system, as well as miscarriages, also may occur as a result of exposures to excessive levels of nitrates (Fan, 1996; Kramer, 1996).

Organic dust, bacterial endotoxins and manure-generated compounds such as ammonia and hydrogen sulfide are also found in CAFO-generated wastes (Schiffman, 2001). Many of the exposures to pollutants from CAFOs are intensified for employees and the people living in neighboring communities. Air polluted with ammonia, hydrogen sulfide, and dust from CAFOs is harming the health of both workers and residents living downwind from these operations.

Several published studies have documented a range of contaminants, microbial agents and health effects in workers exposed to swine (Wing, 2000; Hamscher, 2003; Chapin, 2005; Cole, 2000; Merchant, 2005). These studies provide the groundwork for an increasing body of research to evaluate possible community health effects. Similar to the way second-hand smoke affects not only the smoker but also impacts the health of those nearby, industrial animal production procedures can impact the health of not only workers, but also their families and community members.

Numerous studies describing the adverse respiratory effects occurring among swine CAFO workers and producers have been published in the U.S., Sweden, Canada, the Netherlands and Denmark (Donham, 1989; Holness, 1987; Zejda, 1993; Von Essen, 1998). Results of these investigations concur that approximately 50% of swine workers experience one or more of the following health outcomes: bronchitis, toxic organic dust syndrome (TODS), hyper-reactive airway disease, chronic mucous membrane irritation, occupational asthma, and hydrogen sulfide intoxication. These studies also have shown increased risks of exposure to bacterial and viral infectious agents among swine workers and producers compared to other agricultural cohorts (Thomas, 1994), as well as higher incidences of antibiotic-resistant bacterial infections (Saida, 1981; Nijsten, 1994).

Adverse health outcomes experienced among neighbors of large-scale animal production facilities have been reported in three published, peer-reviewed epidemiological studies. One study evaluated the effect of swine odors on mood in 44 people living near a swine facility (Schiffman, 1995). The results of the study indicated that people living near the swine facility had significantly more depression, tension, anger, fatigue and confusion than control subjects who did not live near a swine facility. In another study, the mental and physical health of 18 people living near a large-scale swine facility was evaluated (Thu, 1997). The results of this study suggested that people living near the facility had significantly elevated rates of physical symptoms that were consistent with symptoms reported in occupational studies of swine workers. A third study compared physical symptoms and quality of life among 155 individuals from 3 different rural communities (Wing, 2000). The community living within 2 miles of a large-scale swine facility reported significantly greater frequency of headaches, runny nose, sore throat, coughing, burning eyes, and diarrhea. Although no published studies have investigated the effects of large-scale poultry operations on the health of nearby neighbors, it is likely that similar health effects could be observed since swine and poultry facilities emit many of the same airborne contaminants.

People living near CAFOs experience serious impacts to water quality such as contaminated wells. (Flora, 2002; Stull, 2004). Community residents living near CAFOs and children of CAFO operators are also exposed to pollutants. A University of Iowa study found that people living near large-scale hog facilities reported higher incidence of head aches, respiratory problem, eye irritation, nausea, weakness, and chest tightness (Thu, 1997). Children of CAFO operators in Iowa have higher rates of asthma than do other farm children (Merchant, 2005). Several studies have also documented increased rates of physical and mental illness among people living near CAFOs (Wing, 2000).

Should Avian Flu take hold among the poultry CAFOs in the U.S. that currently produce about 8 billion chickens, turkeys, and ducks per year for human consumption, the workers involved in feeding, watering, catching, transporting, processing, and cleaning the barns for the next batch of 25–30 thousand birds would likely be at significant risk for bird-to-human movement of the H5N1 virus.

The need for greater public health scrutiny of IAP animal feed composition is well illustrated by the cases of bovine spongiform encephalopathy (BSE or mad cow disease). Animal feed that includes BSE-contaminated tissue (i.e., brain, spinal cord, etc.) is a prime way for the disease to spread. Chicken litter (feces, feathers, spilled feed) is still used in cattle feed, and the controls for monitoring the inclusion of “downer” cattle and slaughterhouse offal in poultry feed are inadequate to assure that prions (the abnormally folded proteins responsible for BSE) don't enter the feed supply for poultry and, subsequently, the poultry litter used for cattle feed.

2. Industrial animal production results in the release of high levels of gases, odors, nutrients, pathogens and antibiotic resistant bacteria into the air, water, and soil.

Air

More than 160 compounds have been identified in airborne emissions from swine CAFOs (Spoelstra, 1980). These compounds can be grouped into 3 categories: gases and vapors; bioaerosols; and non-biologic aerosols (Cole, 2000; Donham, 1977; Olsen, 1996; Pickrell, 1991).

The gases associated with CAFOs of primary concern to public health are ammonia, hydrogen sulfide, carbon monoxide and methane. The main sources of these gases include poultry and swine facilities, windrows of stored poultry litter, cesspits adjacent to swine barns, and land-applied poultry litter and swine wastes. At high concentrations, ammonia and hydrogen sulfide adversely affect the respiratory system, and cause eye and skin irritation. The swine-related bioaerosols of concern to public health are endotoxins. Endotoxins are fragments of gram-negative bacteria that are generally present in high concentrations at a swine production facility. When endotoxins are inhaled, chronic respiratory symptoms such as coughing and wheezing, pulmonary impairment, and fever can result (Douwes, 1997).

Bioaerosols present in and around CAFOs include (but are not limited to) bacteria, antibiotic-resistant bacteria and endotoxins. Recent studies have shown that 98% of airborne bacteria present in large-scale swine and poultry operations are resistant to multiple antibiotics that are used in both animal production and human medicine (Chapin, 2005; McCarthy, in preparation).

Water

The presence of bacterial and protozoan pathogens in ground water intended for drinking water can cause mild to severe bouts of gastroenteritis, depending on the immune status and age of the affected individual. Contracting antibiotic-resistant bacterial infections can pose serious challenges in treatment. Studies published in the *New England Journal of Medicine* have shown an association between the use of antibiotics in animal production operations and antibiotic-resistant bacterial infections in humans (Molbak, 1999; Smith, 1999). Other studies of poultry, poultry farmers and poultry slaughterers have documented the spread of antibiotic-resistant *Enterococcus* sp. and *Escherichia coli* from poultry to humans (van den Bogaard, 2001; van den Bogaard, 2002).

In 1998, the Centers for Disease Control and Prevention, the U.S. government's lead agency for protecting the safety and health of Americans, conducted a pilot investigation of the microbial and chemical constituents of water and other environmental media affected by poultry litter around large poultry operations (Karpati, 1998). Results from this study indicated that ground water and/or surface waters near large-scale poultry operations were contaminated with the following:

- Nutrients, including nitrite, nitrate, ammonia and Kjeldahl nitrogen
- Solutes, including chloride, barium and copper
- Pesticides, including atrazine, methoxychlor, alachlor, metolachlor and cyanazine
- Antibiotic residues, including tetracyclines and fluoroquinolones
- Bacterial pathogens, including, *Escherichia coli, Salmonella* sp., and *Enterococcus* sp.
- Antibiotic-resistant *Escherichia coli, Salmonella* sp., and *Enterococcus* sp.

The CDC also investigated the microbial and chemical constituents of ground and surface water near a swine CAFO (Campagnolo, 1998). This study revealed that ground water and surface waters near the swine CAFO were contaminated with the following:

- Nutrients, including phosphate, nitrate and nitrite
- Common ions, including arsenic
- Trace elements
- Antibiotics
- Parasitic oocysts of *Cryptosporidium parvum*

- Bacteria, including *E. coli, Enterococcus,* and *Salmonella,* all demonstrated antibiotic-resistance to antibiotics that are commonly used as feed additives in swine production. Most of these antibiotics are also used in human medicine to treat clinical disease.

Soil

Manure land application in excess of the land's absorptive capacity also can lead to excess nitrogen and phosphorus in soil, eutrophication of surface waters and algae overgrowth—including some algae that produce compounds that are toxic to fish and humans.

3. Current waste management practices in industrial animal production threaten the environment and public health.

Before industrial methods were adopted in animal agriculture, the amount of waste produced by small numbers of animals on family farms was applied to pasture and cropland in amounts that maintained the balance of soil fertility. Coupled with crop rotation and open pasturing of animals most farms were able to maintain an ecologic balance. With the emergence of CAFOs and the associated production in concentrated areas of huge quantities of untreated solid and liquid wastes, the ecologic balance was upset. Current animal production in the U.S. yields 287 million dry tons of waste, more than 270 million dry tons of which is applied to land without any prior treatment.

In contrast, the population of almost 300 million people in the U.S. produces about 6.9 million dry tons of treated waste in municipal treatment facilities, 3.6 million dry tons of which is applied to land as sewage sludge.

Impacts from waste: Rivers and streams

- An estimated 48,000 of the 300,000 impaired U.S. river and stream miles are due to animal feeding operations (USEPA, 2003)
- High levels of estrogens are in effluent from animal feeding operations

Drugs used in CAFOs end up in waste

- Arsenicals used in poultry production for growth promotion and for controlling intestinal parasites lead to 2 million pounds or 2,000 tons of arsenic being introduced into the environment each year from U.S. poultry operations alone.
- 25 million pounds of antibiotics are used in U.S. food animal production in sub-therapeutic doses. About 75% of these antibiotics are excreted into CAFO wastes.

Impacts from waste: Drinking Water

- 1.3 million households have water supplies with nitrate levels above the maximum contaminant level of 10 mg/L. (USEPA, 2002)

In many states, it is legal for CAFO storage cesspits (or what are referred to as "lagoons") to leak millions of gallons of liquid waste, (Simpkins, 2002; Huffman, 1995; Schulte, 1998). Moreover, CAFO cesspits overflow or breech (Mallin, 2000; Wing, 2002). It is also important to note that these cesspits are often located on floodplains, extend below the water table or are sited over alluvial aquifers (valuable drinking water sources but vulnerable microbial contamination) (Simpkins, 2002).

4. Feed ingredients used in industrial animal production are undermining the effectiveness of antibiotics in medical care.

Antibiotics are used extensively at sub-therapeutic levels in CAFOs. The antibiotics are added to animal feeds in addition to arsenic and other metal compounds for growth promotion purposes (Barza, 2002; Sommers, 2002; Momplaisir, 2001). According to the Union of Concerned Scientists, more than 70% of all antibiotics produced in the U.S. are used in animal production. It is estimated that 23 million pounds of antibiotics are used annually in U.S. animal production, as compared to 3 million pounds of antibiotics prescribed for humans. (Mellon, 2002). Most of these medicines are either identical to or very similar to human medicines. There is strong scientific evidence that the antibiotics used in CAFOs contributes to antibiotic resistance transmitted to bacterial pathogens that affect human disease. (Barza, 2002; WHO, 2001). Resistant strains of bacteria that develop in CAFO animals undermine the usefulness of antibiotics in treating humans (Mellon, 2001).

The World Health Organization recognizes that resistant strains of human pathogens have been identified in animal production facilities and has recommended putting an end to the non-therapeutic use of antibiotics in animal husbandry, (WHO, 1997). The American Public Health Association adopted Resolution 2004-13, "Helping Preserve Antibiotic Effectiveness by Stimulating Demand for Meats Produced Without Excessive Antibiotics" thereby recognizing the threat to public health posed by non-therapeutic use of antibiotics in CAFOs (APHA, 2004).

All uses of antibiotics inevitably lead to the selection of resistance organisms. In human medicine this problem is approached by selective use of antibiotics for confirmed bacterial infections, encouraging patients to complete the full course of treatment to eradicate the infection, and to educate patients and doctors alike that over-prescribing of antibiotics for such things as viral upper respiratory infections contributes to the emergence of antibiotic-resistant organisms. Antibiotic resistant bacteria, especially in hospital-acquired infections, are an increasingly serious clinical problem. The same classes of drugs are used in food animal production as in clinical medicine.

How is antibiotic use in industrial animal production related to human health?

- Animals are given antibiotics in their feed throughout their life
- Antibiotic resistant bacteria are selected out in the gut of the animal

Antibiotic resistant bacteria in animal waste ends up on the meat and in the environment. Human exposure to antibiotic resistant bacteria then occurs from ingesting contaminated foods, breathing air containing bacteria, and drinking contaminated water.

CDC recognizes that virtually all important bacterial pathogens in the U.S. are becoming resistant to currently available antibiotics. In 1998, the National Academy of Sciences estimated that antibiotic resistant bacteria costs the US $4 – 5 billion each year in hospitalizations for protracted infections, loss of work, and premature death or disability.

<u>Total Burden of Foodborne Illnesses</u> (*CDC, Emerging Infectious Diseases, 1999)*

- Illnesses: 76,000,000
- Hospitalizations: 323,000
- Deaths: 5,200

A global problem needs global leadership: bacteria without borders

- Drug resistant salmonella, originating in Japanese fish farms, reached US in 3 years
- Bacteria move by wind from Africa to the US
- Wild birds carry bacterial and viral diseases across oceans
- Antibiotic resistance genes are picked up and transferred among bacterial populations, from non-pathogenic to pathogenic strains

The rate of spread of these antibiotic resistant genes and organisms is a function of how many hosts (people or food animals) are exposed to sub-therapeutic doses of antibiotics.

Summary

The public health threat of CAFOs reflects the multiple exposure routes through air, water, and soil of harmful gases, pollutants such as sulfur dioxide and nitrates, and pathogenic micro—organisms.

Gases, odors and nutrients are problematic but are not the only public health concern.

Antibiotic resistant bacteria are a major public health threat.

These real and urgent public health issues associated with CAFOs warrant strengthening rather than lowering the standards regarding air and water quality.

To date, no swine producing state has been able to control adequately manure waste and airborne emissions from swine CAFOs, such that potential environmental health problems and public health problems among neighboring landowners are eliminated.

Given the current situation and the efforts by large producers to introduce CAFOs to new areas of the U.S., now is not the time to be reducing the regulatory attention that CAFOs receive.

The documented harmful health effects of CAFOs motivated the American Public Health Association in 2003 to adopt a resolution calling for a moratorium on the building of new CAFOs until additional data can be gathered and policies implemented to protect public health.

Testimony submitted by:

Robert S. Lawrence, MD
Edyth Schoenrich Professor of Preventive Medicine
Professor of Health Policy and Environmental Health Sciences
Director, Center for a Livable Future
Johns Hopkins Bloomberg School of Public Health
615 N. Wolfe St., Baltimore MD 21205

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